

EARTH OBSERVATION SYMPOSIUM (B1)  
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TOWARD PERMANENT OPTICAL OBSERVATION SYSTEMS - CONSTELLATIONS TO  
GEOSTATIONARY OBSERVATORY**Abstract**

Earth Observation Optical System have reached a very high spatial resolution. The next frontier is to provide also high temporal revisit, targeting permanent observation system. The need is driven, not only by defense applications but also by security (frontier monitoring, traffic smuggling surveillance, counter terrorist), disaster monitoring. Making a synthesis of TAS new RD and system concept studies, the paper will address first the survey of applications and the associated main driving requirements for the space system. Then the different systems and spacecraft concepts and potential capacities to cover these needs will be addressed. The analysis takes into account recent and on-going enabling technologies to derive system architecture and orbital concepts, which are becoming not only feasible but efficient and affordable. The concepts trades will cover :

- the orbits from: Low Earth Constellations (Sun Synchronous or inclined);
- different types of MEO orbits (Circular , equatorial or inclined, elliptical Sun Synchronous) with apogees between 6000km and about 20 000km, which offer interesting mission capacities and becomes viable thanks to improvement of radiation hardening, as demonstrated on recent TAS programs, such as a recent MEO telecom constellation;
- high altitude geostationary or geosynchronous orbits.

The launch and transfer solution covering: multi-planes deployment of constellation, effective transfer to high energy operational orbits. The operability and command / control concept The technologies will consider both satellite and optical instrument technologies:

- Satellite series production approaches to reduce recurring costs (building on benefit of recent constellations developments: Globalstar 2, Iridium).
- Technology to build light weighted large pupil (above 1.5m) telescope to target submeter resolution from high altitude (6000 to 36 000km), such as active optics (Active correction of M1-M2 by a 5 DDL mechanism, Wave Front Analyser, deformable small mirror to correct wave front errors) to deployable optics toward Aperture Synthesis systems.
- Detection technologies
- Communication architecture (to ground, to data-relay satellite or using inter-satellite links).
- High Isp propulsion (either electrical or unified with high thrust) to reduce transfer cost to high altitude.

Trade-off of system and spacecraft concepts will be performed for the different applications, taking into account: mission performances (responsiveness, permanence, timeliness, number of target), cost effectiveness, ownership, technology.

The paper will conclude in the identification of most promising concepts, including some ruptures wrt. current approaches and give the priority for technologies development.